

Table S1. ANOVA table for the main and interaction effects of year, treatment and depth on the concentration of Mehlich III extractable Manganese, Copper, Boron, Zinc, Iron, and soil pH in the crop residue long term experiment.

Source of variation	Manganese	Copper	Boron	Zinc	Iron	pH
Year (Y)	0.07	0.53	0.02	0.07	<0.01	0.09
Treatment (T)	<0.01	<0.01	<0.01	<0.01	0.32	<0.01
Y × T	<0.01	0.04*	0.02	<0.01	0.32	0.93
Depth (D)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Y × D	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
T × D	<0.01	0.80	<0.01	<0.01	0.51	<0.01
Y × T × D	0.03	0.72	<0.01	<0.01	0.10	0.46

*Significant effects ($p < 0.05$) that require multiple means comparison are shown in bold.

Table S2. Mean concentration of Mehlich III extractable manganese obtained from the 120 combinations of Treatment, Year and Depth (cm) after 84 years for the crop residue long-term experiment.

Depth (cm)	FB ¹	GP	FYM	NB	NB45	NB90	PV	SB	SB45	SB90
<u>(mg Mn kg⁻¹)</u>										
1995										
0-10	B ² 102.1 ab ³	A 176.5 a	A 163.4 a	B 116.8 a	B 107.8 a	B 105.5 ab	A 150.5 a	B 111.9 a	B 93.2 a	B 101.6 a
10-20	CD 108.0 a	A 148.7 a	AB 143.5 a	CD 111.8 a	D 103.3 a	CD 109.2 a	ABC 133.3 a	BCD 115.1 a	D 95.7 a	D 97.9 a
20-30	ABC 78.3 bc	AB 90.3 bcd	ABC 80.2 cd	ABC 77.8 b	BC 75.0 bc	BC 70.9 cd	A 100.8 b	AB 85.4 b	C 64.0 bcd	BC 66.0 bc
30-60	ABC 66.6 cd	A 89.4 bcd	AB 76.7 cd	C 55.5 cd	BC 63.9 bcd	BC 61.4 cde	AB 82.6 bc	BC 61.8 cde	C 48.1 de	C 48.9 cd
2005										
0-10	B 97.5 ab	A 149.1 a	B 96.5 bc	B 88.6 ab	B 83.3 ab	B 81.6 bc	B 78.7 bc	B 85.2 b	B 82.1 ab	B 80.2 ab
10-20	A 61.0 cde	A 79.5 cd	A 80.1 cd	A 72.0 bc	A 68.7 bc	A 71.5 cd	A 72.3 cd	A 74.0 bcd	A 70.8 abc	A 69.3 bc
20-30	AB 54.4 de	A 68.4 d	AB 53.5 e	B 45.3 d	AB 48.4 de	B 37.8 f	AB 55.4 de	AB 48.0 e	B 44.8 de	AB 48.3 cd
30-60	B 46.0 e	A 84.2 cd	B 55.8 e	B 53.4 cd	B 59.0 cde	B 45.2 ef	B 46.7 e	B 56.4 de	B 55.3 cd	B 49.3 cd
2015										
0-10	E 59.3 cde	A 170.6 a	B 114.3 b	DE 65.2 bc	DE 61.9 bcd	DE 63.6 cde	BC 88.3 bc	CD 83.6 bc	E 56.5 cd	DE 61.4 bc
10-20	CD 68.5 cd	A 162.2 a	B 99.2 bc	CD 71.4 bc	D 56.4 cde	D 56.5 def	B 95.4 b	BC 84.4 b	D 51.1 cde	D 53.0 cd
20-30	D 57.0 cde	A 115.2 b	AB 105.9 b	CD 68.7 bc	CD 64.0 bcd	D 60.4 cde	AB 92.8 bc	BC 86.5 b	D 50.3 cde	D 52.5 cd
30-60	CD 42.1 e	A 105.8 bc	B 70.1 de	CD 40.5 d	CD 41.9 e	CD 41.6 f	BC 56.4 de	BCD 51.9 e	D 37.3 e	D 36.8 d

¹ FB = fall burn; GP = grass pasture; FYM = farmyard manure; NB, NB45 and NB90 = No burn with N applied at 0 kg ha⁻¹, 45 kg ha⁻¹, and 90 kg ha⁻¹, respectively; PV = pea vine; SB, SB45 and SB90 = spring burn with N applied at 0 kg ha⁻¹, 45 kg ha⁻¹, and 90 kg ha⁻¹, respectively.

² Upper case letters are a comparison of the 10 treatments within each year and depth, and ³lower-case letters are a comparison of the 12 combinations of year and depth within each of the 10 treatments. Means sharing the same letter are not significantly different ($p > 0.05$).

Table S3. Mean concentration of Mehlich III extractable boron obtained from the 120 combinations of Treatment, Year and Depth (cm) after 84 years of the crop residue long-term experiment.

Depth (cm)	FB ¹	GP	FYM	NB	NB45	NB90	PV	SB	SB45	SB90
<u>(mg B kg⁻¹)</u>										
1995										
0-10	C ² 1.48 a ³	D 0.17 a	BC 2.04 a	BC 2.74 a	A 7.95 a	A 7.95 a	C 1.75 ab	C 1.50 a	A 7.25 a	A 7.93 a
10-20	B 1.51 a	C 0.00 a	B 2.17 a	AB 3.72 a	A 8.04 a	A 7.97 a	B 1.74 ab	B 1.62 a	A 6.91 a	A 7.97 a
20-30	BC 1.51 a	D 0.00 a	BC 1.95 a	AB 3.82 a	A 8.26 a	BC 2.01 bc	BC 1.91 a	BC 1.75 a	A 7.09 a	A 8.11 a
30-60	BC 1.78 a	D 0.00 a	BC 1.98 a	AB 3.86 a	A 8.42 a	BC 1.97 bc	B 2.13 a	BC 1.77 a	A 7.94 a	A 8.29 a
2005										
0-10	B 1.24 a	C 0.00 a	AB 1.97 a	AB 1.59 a	AB 3.61 ab	AB 3.60 ab	B 1.53 ab	B 1.63 a	A 4.95 a	A 4.90 ab
10-20	B 1.35 a	B 0.00 a	B 1.92 a	A 2.53 a	A 3.52 ab	A 3.24 ab	B 1.46 ab	B 1.61 a	A 4.58 a	A 4.72 ab
20-30	B 1.36 a	B 0.00 a	AB 1.63 a	AB 2.47 a	AB 3.60 ab	AB 3.28 ab	AB 1.46 ab	AB 1.56 a	A 5.00 a	A 4.68 ab
30-60	AB 1.30 a	B 0.00 a	AB 1.69 a	AB 2.64 a	AB 3.59 ab	AB 3.34 ab	AB 1.41 ab	AB 1.56 a	A 4.68 a	AB 2.36 bc
2015										
0-10	B 0.51 a	C 0.00 a	B 0.84 a	B 0.27 b	B 1.18 b	B 0.51 c	B 0.31 b	B 0.58 a	B 0.16 b	B 0.94 c
10-20	B 0.54 a	C 0.00 a	B 0.85 a	B 0.24 b	B 1.19 b	B 0.52 c	B 0.38 ab	B 0.53 a	B 0.21 b	B 0.81 c
20-30	A 0.53 a	B 0.00 a	A 0.59 a	A 0.23 b	A 1.13 b	A 0.59 c	A 0.38 ab	A 0.71 a	A 0.20 b	A 1.45 bc
30-60	A 0.55 a	B 0.00 a	A 0.49 a	A 0.28 b	A 1.37 b	A 0.61 c	A 0.33 b	A 0.80 a	A 0.91 b	A 1.19 c

¹ FB = fall burn; GP = grass pasture; FYM = Farmyard manure; NB, NB45 and NB90 = No burn with N applied at 0 kg ha⁻¹, 45 kg ha⁻¹, and 90 kg ha⁻¹, respectively; PV = pea vine; SB, SB45 and SB90 = spring burn with N applied at 0 kg ha⁻¹, 45 kg ha⁻¹, and 90 kg ha⁻¹, respectively.

² Upper case letters are a comparison of the 10 treatments within each year and depth, and ³ lower-case letters are a comparison of the 12 combinations of year and depth within each of the 10 treatments. Means sharing the same letter are not significantly different ($p > 0.05$).

Table S4. Mean concentration of Mehlich III extractable zinc obtained from the 120 combinations of Treatment, Year and Depth (cm) after 84 years of the crop residue long-term experiment (CR-LTE).

Depth (cm)	FB ¹	GP	FYM	NB	NB45	NB90	PV	SB	SB45	SB90
<u>(mg Zn kg⁻¹)</u>										
1995										
0-10	B ² 1.53 bc ³	A 6.08 a	B 2.28 b	B 2.49 ab	B 1.21 bcd	B 1.19 cd	B 1.68 abcd	AB 2.55 abc	B 1.31 abc	B 1.27 abcd
10-20	B 1.66 bc	AB 3.04 ab	A 2.77 b	B 1.49 bc	B 1.12 bcd	B 1.21 bcd	B 1.61 bcde	AB 2.13 abcd	B 1.44 ab	B 1.44 abc
20-30	AB 0.72 cd	C 0.67 cd	AB 0.91 c	A 1.49 bc	AB 0.61 cd	AB 0.69 d	AB 0.68 ef	AB 0.92 efg	AB 0.74 bc	AB 0.59 cd
30-60	A 0.27 d	C 0.39 d	A 0.54 c	A 0.83 c	A 0.27 d	A 0.64 d	A 0.28 f	A 0.27 g	A 0.38 c	A 0.34 d
2005										
0-10	B 1.31 bc	A 6.19 a	B 2.58 b	B 1.61 abc	B 1.39 abc	B 1.38 abcd	B 1.70 abcd	B 1.85 bcde	B 1.51 ab	B 1.40 abc
10-20	A 1.27 cd	B 0.43 d	A 1.93 b	A 1.33 c	A 1.23 bcd	A 1.23 bcd	A 1.49 cde	A 1.46 def	A 1.23 abc	A 1.18 bcd
20-30	A 0.95 cd	A 0.91 cd	A 0.80 c	A 0.74 c	A 0.81 cd	A 0.73 d	A 0.74 def	A 0.73 fg	A 0.73 bc	A 0.90 cd
30-60	AB 0.76 cd	AB 1.14 cd	AB 0.94 c	AB 0.80 c	A 1.39 abc	AB 0.81 d	AB 0.81 def	AB 0.86 efg	AB 0.81 bc	AB 0.80 cd
2015										
0-10	B 2.31 ab	A 6.41 a	A 5.01 a	B 2.32 ab	B 2.24 a	B 2.26 a	B 2.48 abc	B 2.83 ab	B 2.23 a	B 2.21 a
10-20	B 2.75 a	A 4.99 ab	A 4.63 a	B 2.62 a	B 2.32 a	B 2.03 ab	B 2.69 a	B 3.02 a	B 2.16 a	B 2.08 ab
20-30	B 2.23 ab	B 1.49 cd	A 5.14 a	B 2.36 ab	B 2.12 ab	B 2.21 ab	B 2.60 ab	B 2.89 a	B 2.13 a	B 2.20 a
30-60	A 1.66 bc	A 1.40 cd	A 2.03 b	A 1.59 bc	A 1.79 ab	A 1.87 abc	A 1.65 bcd	A 1.65 cdef	A 1.86 a	A 2.13 ab

¹ FB = fall burn; GP = grass pasture; FYM = farmyard manure; NB, NB45 and NB90 = No burn with N applied at 0 kg ha⁻¹, 45 kg ha⁻¹, and 90 kg ha⁻¹, respectively; PV = pea vine; SB, SB45 and SB90 = spring burn with N applied at 0 kg ha⁻¹, 45 kg ha⁻¹, and 90 kg ha⁻¹, respectively.

² Upper case letters are a comparison of the 10 treatments within each year and depth, and ³ lower-case letters are a comparison of the 12 combinations of year and depth within each of the 10 treatments. Means sharing the same letter are not significantly different ($p > 0.05$).

Table S5. Mean concentration of Mehlich III extractable copper obtained from the 30 combinations of Treatment and Year after 84 years of the crop residue long-term experiment (CR-LTE).

	FB ¹	GP	FYM	NB	NB45	NB90	PV	SB	SB45	SB90
Year	(mg Cu kg ⁻¹)									
1995	AB ² 3.50 a ³	BC 2.68 a	BC 2.98 a	BC 3.00 a	AB 3.37 a	A 4.02 a	AB 3.31 a	AB 3.42 a	C 2.49 b	BC 2.85 a
2005	A 3.30 a	A 2.89 a	A 3.31 a	A 3.54 a	A 3.76 a	A 3.26 a	A 3.29 a	A 3.47 a	A 3.59 a	A 3.50 a
2015	AB 3.31 a	B 2.56 a	A 3.46 a	AB 3.13 a	AB 2.91 a	AB 3.25 a	AB 3.16 a	A 3.59 a	AB 3.05 a	AB 3.35 a

¹FB = fall burn; GP = grass pasture; FYM = Farmyard manure; NB, NB45 and NB90 = No burn with N applied at 0 kg ha⁻¹, 45 kg ha⁻¹, and 90 kg ha⁻¹, respectively; PV = pea vine; SB, SB45 and SB90 = spring burn with N applied at 0 kg ha⁻¹, 45 kg ha⁻¹, and 90 kg ha⁻¹, respectively.

² For each variable, upper case letters are a comparison of the 10 treatments within each year for copper, and ³ lower-case letters are a comparison of the 3 years for copper within each of the 10 treatments. Means sharing the same letter are not significantly different ($p > 0.05$).

Table S6. ANOVA table of the main and interaction effects of year and treatment on the accumulation of Mn, Cu, B, Fe, and Zn in the grain and straw of wheat in the crop residue long-term experiment.

Source of variation	Manganese	Copper	Boron	Zinc	Iron
Wheat Grain					
Treatment	<0.01*	0.12	ND ¹	<0.01	<0.01
Year	0.05	0.02	ND	0.03	0.13
Treatment*Year	0.76	0.08	ND	0.99	0.01
Wheat straw					
Treatment	<0.01	0.07	0.06	0.71	0.01
Year	0.02	0.02	0.16	0.04	<0.01
Treatment*Year	<0.01	0.26	0.19	0.71	0.11

*Significant effects ($p < 0.05$) that require multiple means comparison are shown in bold.

¹ND: Not detected.

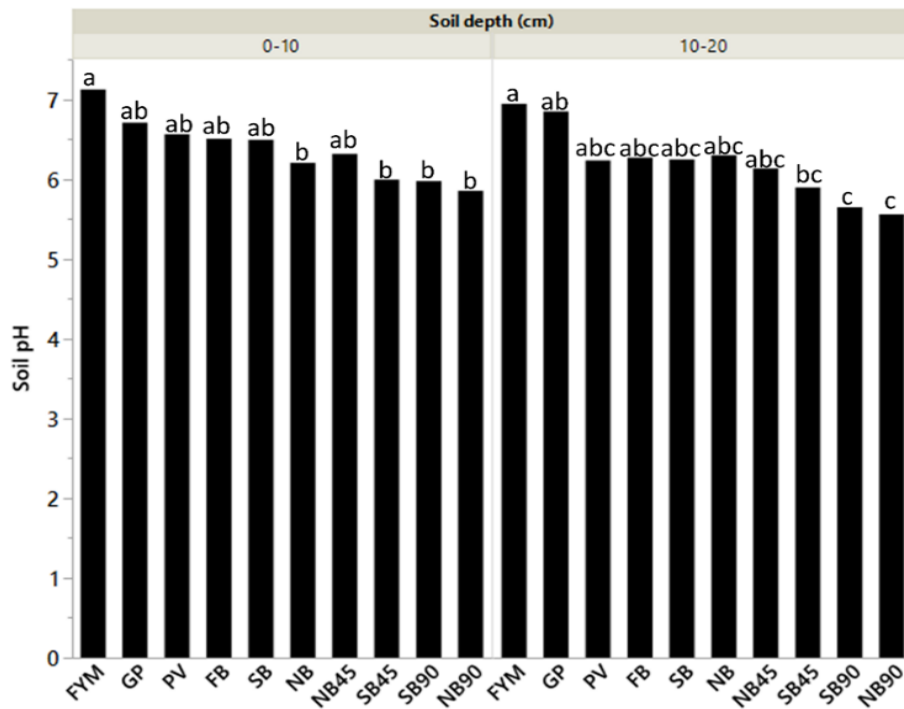


Figure S1. Effect of residue management on soil pH over time in the 0-10 cm and 10-20 cm soil depths.

FB = fall burn; GP = grass pasture; FYM = Farmyard manure; NB, NB45 and NB90 = No burn with N applied at 0 kg ha⁻¹, 45 kg ha⁻¹, and 90 kg ha⁻¹, respectively; PV = pea vine; SB, SB45 and SB90 = spring burn with N applied at 0 kg ha⁻¹, 45 kg ha⁻¹, and 90 kg ha⁻¹, respectively.

Means sharing the same letter are not significantly different within each soil depth at 0.05 probability level.